PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant	:	James A. Folta et al.	Attorney Docket: CIL-10725
Serial No.	:	09/817,334	Art Unit: 2878
Filed	:	March 21, 2001	Examiner: S. Allen
For	:	Fabrication Of Precision Optics Using An Imbedded Reference Surface	

BRIEF ON APPEAL

This is an appeal to the Board of Patent Appeals and Interferences from the final rejection of Claims 1-32 mailed December 29, 2003. On March 29, 2004, a timely Notice of Appeal was filed.

I. REAL PARTIES IN INTEREST

The real parties in interest are the Extreme Ultraviolet LLC, the Regents of the University of California and the United States of America as represented by the United States Department of Energy.

II. RELATED APPEALS AND INTERFERENCES

Appellant knows of no other appeals or interferences that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-32 are pending on appeal and stand rejected. A copy of the claims on appeal is set forth in Appendix I.

IV. STATUS OF AMENDMENTS

All prior amendments have been entered.

V. SUMMARY OF INVENTION

In an exemplary embodiment of the present invention, the substrate is measured with a very precise instrument such as an embodiment of the Phase Shifting Diffraction Interferometer disclosed in U.S. Patent No. 5,548,403, titled "Phase Shifting Diffraction Interferometer" and U.S. Patent No. 5,933,236, titled "Phase Shifting Interferometer". If a figure-correcting layer is made of material that has a different index of refraction from that of the substrate, then the figure-correcting layer may be deposited directly on the substrate surface. If a figure-correcting layer is made of material that has nearly the same index of refraction as that of the substrate, then a marker layer is deposited onto the substrate and the figure-correcting layer is deposited directly on the marker layer. The thickness of the figure-correcting layer is locally measured and the desired thickness is obtained from the PSDI measurement. Adding the thickness of the figure-correcting layer to the figure of the substrate is readily performed with many commercially available numerical analysis or image processing software products. The local measurement of the figure-correcting layer is accomplished through a variety of methods, including interferometry and fluorescence or ultrasound measurements. Adjustments in the thickness of the figure-correcting layer are made until the top of the figure-correcting layer matches the figure specification.

VI. ISSUES

Whether claims 1, 2, 5, 6, 9-11, 14-17, 19 and 21 are anticipated by Berman et al.

Whether claims 3, 7, 8, 18, 20 and 22 are unpatentable over Berman.

Whether claims 4, 8 and 23-32 are unpatentable over Berman in view of Geullich.

Whether claim 12 is unpatentable over Berman in view of Katzir et al.

Whether Claim 13 is unpatentable over Berman in view of Ju et al.

VII. GROUPING OF CLAIMS

Claims 1-24 and 26-32 stand and fall together.

VIII. ARGUMENT

Are claims 1, 2, 5, 6, 9-11, 14-17, 19 and 21 anticipated by Berman et al.?

The applicants' claim 1 recites the step of "measuring the thickness of said figure-correcting layer." Berman et al. does not measure the thickness of the figure-correcting layer. The Examiner argues that a measurement of the contour of a layer is synonymous with a measurement of the thickness of a layer. The applicants respectfully disagree. The Examiner specifically points to column 2, lines 7-58. The reference describes measuring the contour with dial indicators, a transverse probe or an interferometer. Although the reference includes the use of an interferometer, which is the one class of instrument used in the present invention, the way the reference uses the

interferometer is different from that of the present invention in that the reference measures topology only. See column 2, lines 20-28. Claims 1 and 23 of the present invention include the step of measuring the thickness of the figure-correcting layer. As discussed in the Summary Of Invention above, if the figure-correcting layer is made of a material that has a different index of refraction than that of the substrate, then the interference pattern produced from light reflected from the two layers can be used to calculate the thickness of the figure-correcting layer. If the figure-correcting layer has the same index of refraction as that of the substrate, then a marker layer is placed between the two layers to provide a contrast. Claims 2-31 depend from claim 1 and claims 24 and 26-32 depend from claim 23. Claim 25 has been canceled. Therefore the rejection should be withdrawn.

Are claims 3, 7, 18, 20 and 22 unpatentable over Berman?

The rejection of claims 3, 7, 18, 20 and 22 should be withdrawn because they depend from claim 1 which should be allowable over Berman as discussed above.

Are claims 4, 8 and 23-32 unpatentable over Berman in view of Geullich?

The rejection of claims 4 and 8 should be withdrawn because they depend from claim 1. As discussed above, claim 23 includes the step of "measuring the thickness of said figure-correcting layer" which is missing from the Berman reference and the Geullich reference. Claims 24 and 26-32 depend from claim 23. Claim 25 has been canceled. Therefore the rejection should be withdrawn.

Is claim 12 unpatentable over Berman in view of Katzir et al.?

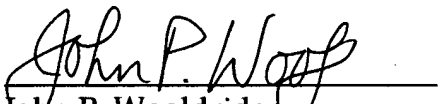
The rejection of claim 12 should be withdrawn since it depends from claim 1.

Is Claim 13 unpatentable over Berman in view of Ju et al.?

The rejection of claim 13 should be withdrawn since it depends from claim 1.

Accordingly it is submitted that the rejections of claims 1-32 are improper and should be reversed.

Respectfully submitted,



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IX APPENDIX I

1. A method for correcting the figure of a substrate, comprising:

measuring the figure of a surface of said substrate;

attaching a figure-correcting layer to a surface of said substrate;

locally adjusting the thickness of said figure-correcting layer; and

measuring the thickness of said figure-correcting layer.

2. The method of claim 1, further comprising iterating between the steps of locally adjusting the thickness of said figure-correcting layer and measuring the thickness of said figure-correcting layer until a desired figure is obtained.

3. The method of claim 1, wherein said figure-correcting layer comprises an index of refraction that is nearly the same as the index of refraction of said substrate.

4. The method of claim 3, further comprising applying a marker layer to said substrate before applying said figure-correcting layer, wherein said marker layer is located between said substrate and said figure-correcting layer.

5. The method of claim 1, wherein the step of measuring the figure of said substrate is carried out with a phase shifting diffraction interferometer.

6. The method of claim 1, wherein the thickness of said figure-correcting layer is known.

7. The method of claim 1, wherein said figure-correcting layer comprises an index of refraction that is different from the index of refraction of said substrate.

8. The method of claim 1, wherein said figure-correcting layer comprises an optical material having embedded material selected from the group consisting of Al, Cr, Co, Ni, Ti, Mo, and Si.

9. The method of claim 1, wherein the step of locally adjusting the thickness of said figure-correcting layer is carried out with a beam selected from the group consisting of an electron beam, an ion beam and an electromagnetic beam.

10. The method of claim 9, wherein said electromagnetic beam comprises light selected from the group consisting of visible light, ultraviolet light, infrared light and x-ray light.

11. The method of claim 1, wherein the step of measuring the thickness of said figure-correcting layer is carried out with an optical method selected from the group consisting of interferometry and reflectance spectroscopy.

12. The method of claim 1, wherein the step of measuring the thickness of said figure-correcting layer is carried out with fluorescence.

13. The method of claim 1, wherein the step of measuring the thickness of said figure-correcting layer is carried out with ultrasound.

14. The method of claim 1, further comprising comparing said thickness of said figure-correcting layer to said figure of said surface of said substrate to determine the figure of the substrate in combination with said figure-correcting layer.

15. The method of claim 1, wherein the step of locally adjusting the thickness of said figure-correcting layer comprises adding material to said figure-adjusting layer.

16. The method of claim 1, wherein the step of locally adjusting the thickness of said figure-correcting layer comprises removing material from said figure-adjusting layer.

17. The method of claim 1, wherein the step of locally adjusting the thickness of said figure-correcting layer comprises adding material to said figure-correcting layer and removing material from said figure-correcting layer.

18. The method of claim 1, wherein the step of locally adjusting the thickness of said figure-correcting layer is carried out with a polishing tool.

19. The method of claim 1, wherein the step of measuring the thickness of said figure-correcting layer is carried out at a plurality of points simultaneously.

20. The method of claim 19, wherein the step of measuring the thickness of said figure-correcting layer at a plurality of points simultaneously is carried out with a two-dimensional detector.

21. The method of claim 1, wherein the step of measuring the figure of said surface of said substrate is carried out prior to the step of applying a figure-correcting layer to a surface of said substrate.

22. The method of claim 1, wherein the step of measuring the figure of said surface of said substrate is carried out after the step applying a figure-correcting layer to a surface of said substrate.

23. A method for correcting the figure of a substrate, comprising:

attaching a figure-correcting layer to an interface;

attaching said interface to a surface of said substrate, wherein said interface is between said substrate and said figure-correcting layer;

locally adjusting the thickness of said figure-correcting layer to produce a desired surface figure; and

measuring the thickness of said figure-correcting layer.

24. The method of claim 23, further comprising measuring the figure of said substrate either before or after the step of applying a figure-correcting layer.

25. (Canceled)

26. The method of claim 23, further comprising iterating between the steps of locally adjusting the thickness of said figure-correcting layer and

measuring the thickness of said figure-correcting layer until a desired figure is obtained.

27. The method of claim 23, wherein said figure-correcting layer comprises an index of refraction that is nearly the same as the index of refraction of said substrate, wherein said interface comprises a marker layer.

28. The method of claim 23, wherein said figure-correcting layer comprises an index of refraction that is different from the index of refraction of said substrate.

29. The method of claim 23, wherein the step of locally adjusting the thickness of said figure-correcting layer is carried out with a beam selected from the group consisting of an electron beam, an ion beam and an electromagnetic beam.

30. The method of claim 23, wherein the step of measuring the thickness of said figure-correcting layer is carried out with an optical method selected from the group consisting of interferometry, optical reflectance spectroscopy, ultrasound reflectance spectroscopy and fluorescence measurement.

31. The method of claim 23, further comprising comparing said thickness of said figure-correcting layer to said figure of said surface of said substrate to determine the figure of the substrate in combination with said figure-correcting layer.

32. The method of claim 23, wherein the step of locally adjusting the thickness of said figure-correcting layer is carried out with a step selected from the group consisting of adding material to said figure-adjusting layer, removing material from said figure-adjusting layer and a combination of adding material to said figure-correcting layer and removing material from said figure-correcting layer.